NRL BAA Announcement
#67-11-01

BASIC AND APPLIED RESEARCH IN HIGH TEMPERATURE PLASMAS

The Naval Research Laboratory (NRL) is interested in receiving proposals that address basic and applied experimental, theoretical and computational research to advance fundamental knowledge in high temperature plasmas.

Specific areas of interest include:

(1) Theory, modeling and simulation describing the interaction of intense ultrashort laser pulses with various target materials for the production of energetic particles such as neutrons, protons, electrons and charged ions as well as x- and gamma-rays for the remote detection of weapons of mass destruction (WMD) materials. Advanced computer models combining hydrodynamics and radiation physics in dense plasmas. Atomic physics in high intensity fields. Physics of laser–cluster dynamics, x-ray channeling and propagation. Theoretical and computational studies of plasma chemistry and processes for application to air chemistry and excimer lasers.

(2) (a) Theoretical and experimental studies of krypton-fluoride laser systems, both single pulse and repetitively pulsed, includes pulsed power, optics and electron beam generation, propagation and transport. Theoretical and experimental studies of the effects of laboratory thermonuclear explosions upon the chamber walls and upon the final optics. Study of means for fabrication and injection of targets for high-gain laser fusion. (b) Study of laser-matter interactions and strongly-coupled plasmas for conditions relevant to direct drive laser fusion. Theory and experimental studies of laser-plasma instability at high intensity that are relevant to laser fusion.

(3) High energy pulsed power systems employing capacitive and inductive energy storage. Production of pulsed plasma and intense high-power, charged particle beams including single pulse and high average (rep-rated) power systems. Modeling and simulation of pulsed power devices and applications. Pulsed-power-driven radiation sources.

(4) Theoretical and large-scale computational modeling of ionospheric, magnetospheric, solar and space plasmas.

(5) Theoretical studies and computer simulations of nonlinear dynamic phenomena and novel nonlinear algorithms for use in applications such as nonlinear time series

analysis, analysis of complex data sets, study of adaptive networks, analysis and control of coupled systems, and emergent structures in stochastic dynamics.

(6) Theoretical and experimental research in the areas of coherent radiation sources, systems, and propagation, including gyrotrons, magnicons, high energy lasers, ultrashort pulse lasers, and free-electron lasers. Theoretical and computational research in beam transport, intense laser-plasma interactions, and intense laser-electron beam interactions.

(7) Diagnostic and data handling/analysis techniques applicable to pulsed or dc measurements for remote sensing and laser-matter interactions, including real time diagnostics and post-interaction analysis.

(8) Theoretical and experimental research into the production of plasmas in neutral gas backgrounds using RF excitation, plasma discharges, beam ionization, or other techniques. Development, testing, and analysis of advanced plasma diagnostics for partially ionized gas distributions. Investigations of the interaction of plasmas with gas distributions, surfaces, or coatings on surfaces. Development or utilization of specialized diagnostics to analyze plasma effects. Analysis of experimental results and comparison with theoretical predictions.

(9) Theoretical and experimental research on high frequency microwave processing of ceramics including modeling of intense microwave-material interactions and development of low cost, high power millimeter wave applicators and sources.

(10) Experimental research in high-velocity electromagnetic launchers. Design of launcher barrels and armatures. Diagnostics of launcher performance. Pulsed power systems for electromagnetic launch.

(11) Theoretical and experimental research on high-energy-density plasma (HEDP) physics, including atomic processes and advanced plasma diagnostics. Physics and simulation of laser produced and Z-pinch produced high-energy-density plasmas. Computational tools to understand the coupling of ionization, radiation transport, and plasma dynamics in HEDP environments.

(12) Development of novel and robust detection systems suitable for high-power pulsed environments, consisting of temporally-, spatially-, and/or spectrally-resolved detectors for x-ray, high-energy gamma, or neutron (both fast and thermal) emissions and mode-differentiating data acquisition electronics.

(13) Theoretical and experimental research to quantify cross-sections of nuclear resonance fluorescence, Coulomb excitation, neutron inelastic scattering, and nuclear excitation via atomic processes of radioisotopes.

(14) Theoretical and experimental research on the generation and diagnosis of space plasmas. Development, testing, and fielding of advanced plasma diagnostics for space plasmas using ground-based simulation chambers or space-based platforms. Integration of advanced diagnostics into space platforms. Interfacing of experimental

hardware with space craft. Acquisition of data, analysis, and comparison with theoretical models or other data.

The foregoing description should be interpreted within the following guidelines which apply to all BAA topics but are stated here for emphasis: (1) NRL is not interested in concepts that have already been developed or proven; (2) NRL seeks proposals for scientific study and experimentation directed toward advancing the state-of-the-art or increasing knowledge or understanding; and (3) deliverables should demonstrate the results of scientific study and experimentation rather than focus on a specific system or hardware solution. Proposals for evolutionary improvements are inappropriate under BAA authority and are not desired.

Address White Papers (WP) to nrlproposals. Allow one month before requesting confirmation of receipt of WP, if confirmation is desired. Substantive contact should not take place prior to evaluation of a WP by NRL. If necessary, NRL will initiate substantive contact.